

REMARKS/ARGUMENTS

Claims 23, 25, 28, 29, and 32-39 are pending in this application.

Claims 23, 25, 28, 29, and 32-39 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Shigeyama (JP 2004-063504).

Applicant respectfully traverses the rejection of claims 23, 25, 28, 29 and 32-39.

Applicant's claim 23 recites:

A method for fabricating a semiconductor device, the method including:
forming an amorphous silicon film on a substrate;
preprocessing the amorphous silicon film by modifying the amorphous silicon film to prepare the amorphous silicon film to be made polycrystalline;
laser processing the amorphous silicon film modified through the preprocessing step for producing a polycrystalline silicon film; and
laser power inspecting/extracting
for inspecting for the presence of a foreign object or an abnormality in the preprocessing step by imaging by use of the amorphous silicon film having undergone the preprocessing step, and
for performing laser preprocessing on a predetermined region of the amorphous silicon film having undergone the preprocessing while varying laser power as an irradiated spot moves, and performing inspection using spectroscopy at each of a plurality of positions at which the laser processing has been performed at different laser powers, to determine a laser power based on a result of the inspection; wherein
the laser processing step uses the laser power determined in the laser power inspection/extraction step. (emphasis added)

In the outstanding Office Action, the Examiner alleged that Shigeyama teaches most of the features recited in Applicant's claim 23, but admitted, "[Shigeyama] does not exactly teach a method for producing a semiconductor device wherein a spectroscopy is performed at a measurement wavelength of about 700 nm to 800 nm, a laser power of about 5mJ or about 10 mJ lower than an optimum laser power value." To attempt to overcome this deficiency in Shigeyama, the Examiner alleged:

[I]n the absence of unobvious results, it would have been obvious to the skilled artisan at the time of the present invention to modify and optimize the process parameter limitation in order to ensure proper orientation. Furthermore it would be obvious to one having ordinary skill in the art to recognize that the

laser power inspecting/extracting is utilized to scan and understand the morphology of the substrate surface as disclosed in the teachings, and as well supported by applicant's remarks. Thus the ability to also include and at least minimally understand the detection of abnormalities in the surface as well.

Expected beneficial results are evidence of obviousness, just as unexpected beneficial results are evidence of unobviousness. In re Novak 16 USPQ 2d 2041 (Fed. Cir., BPAI 1989); In re Hoffman 194 USPQ 126 (CCPA 1977); In re Skoll 187 USPQ 481 (CCPA 1975); In re Skoner 186 USPQ 80 (CCPA 1975); In re Garshon 152 USPQ 602 (CCPA 1967).

Further, in Section No. 3 on pages 4 and 5 of the outstanding Office Action, the Examiner also alleged:

... Sections 0032-0038 of the machine translation [of Shigeyama] do denote the purpose of the laser to determine the morphology and concentration values in the surface of the film, thus precluding to the ability to detect abnormalities in the surface. That device function would be capable of such an endeavor. The ability to do so would be allow for ensuring better quality control standards and parameter optimization of the thin film growth on the semiconductor substrate.

Applicant's do not provide evidence as to why this is the contrary in the sense of an obvious aspect of the claimed invention. Thus examiner is maintaining the said rejection at this time.

Applicant respectfully disagrees with the Examiner's above allegations. First, the Examiner's allegation that the only difference between the features presently recited in Applicant's claim 23 and Shigeyama amounts to a mere optimization of a claimed range is incorrect. Second, Shigeyama does not teach or suggest, and in fact, explicitly teaches away from the method step of "laser power inspecting/extracting for inspecting for the presence of a foreign object or an abnormality in the preprocessing step by imaging by use of the amorphous silicon film having undergone the preprocessing step, and for performing laser preprocessing on a predetermined region of the amorphous silicon film having undergone the preprocessing while varying laser power as an irradiated spot moves, and performing inspection using spectroscopy at each of a plurality of positions at which the laser processing has been performed at different laser powers, to determine a laser power based on a result of the inspection" as presently recited in Applicant's claim 23.

Contrary to the Examiner's allegations, there is nothing in the relevant case law that stands for the general proposition that an Applicant for a patent must make a showing of criticality or unexpected results unless the Examiner has proved that the difference between a claimed invention and the prior art is a range or other variable. *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990). In such a case, Applicant must show that the particular range is critical, generally by showing that the claimed range achieves unexpected results relative to the prior art range. 919 F.2d at 1578.

Here, the difference between Applicant's presently pending claim 23 and Shigeyama is not merely a difference in a range or other variable as alleged by the Examiner. Instead, the difference between Applicant's presently pending claim 23 and Shigeyama lies in the fact that Applicant's laser processing is performed on a predetermined region of the amorphous silicon film that has undergone preprocessing while varying the laser power while moving the irradiated spot, and that Applicant's inspection using spectroscopy is performed at each of a plurality of positions at which the laser processing has been performed at different laser powers, so that the laser power is determined based on the results of the inspection. **Nowhere in Shigeyama or in any other prior art of record is there any teaching or suggestion of laser processing being performed on a predetermined region of an amorphous silicon film that has undergone preprocessing while varying the laser power while moving the irradiated spot, and that of performing spectroscopy at each of a plurality of positions at which the laser processing has been performed at different laser powers, so that the laser power is determined based on the results of the inspection.** Nor has the Examiner even attempted to articulate any reason or motivation for modifying Shigeyama to include such method steps. Instead, the Examiner has ignored the features presently recited in Applicant's claimed invention, these features which the Examiner clearly could not find in the prior art, as being allegedly "optimizable."

The Examiner's allegation of obviousness is improper because, as the Examiner is well aware, "[a] particular parameter must first be recognized as a result-effective variable, i.e., a variable which achieves a recognized result, before the determination of the optimum or

workable ranges of said variable might be characterized as routine experimentation.” *In re Antonie*, 195 USPQ 6 (CCPA 1977) and MPEP §2144.05(II)(B). While “the discovery of an optimum value of a variable in a known process is normally obvious,” *In re Antonie*, 559 F.2d 618, 620 (CCPA 1977), this is not always the case. One exception to the rule is where the parameter optimized was not recognized in the prior art as one that would affect the results. *Id.* Applicant respectfully requests that the Examiner provide some documentary evidence that supports his unsubstantiated allegation that one having ordinary skill in the art at the time of Applicant’s invention would have had some reason or motivation to perform laser processing on a predetermined region of an amorphous silicon film that has undergone preprocessing while varying the laser power applied to the anamorphous silicon film while moving the irradiated spot, and to also perform inspection using spectroscopy at each of a plurality of positions at which the laser processing has been performed at different laser powers, so that the laser power is determined based on the results of the inspection.

Applicant respectfully submits that the Examiner has failed to prove that the specific claimed features of Applicant’s laser processing were known to be a “result-effective variable” that would have been optimizable through routine experimentation by one having ordinary skill in the art the time of Applicant’s invention. Put more succinctly, **the Examiner is respectfully requested to, without referring to the Applicant’s originally filed disclosure, point to any portion of Shigeyama or any other prior art of record that teaches or suggests a problem and that also states that this problem can be corrected by performing laser processing on a predetermined region of an amorphous silicon film that has undergone preprocessing while varying the laser power applied to the amorphous silicon film while moving the irradiated spot, and also performing inspection using spectroscopy at each of a plurality of positions at which the laser processing has been performed at different laser powers, so that the laser power is determined based on the results of the inspection.**

Additionally, even if the Examiner had somehow met the burden of proving that Applicant’s presently claimed laser processing was known to be a “result-effective variable,” which the Examiner clearly has not, one having ordinary skill in the art at the time of Applicant’s

invention would not have modified Shigeyama in such a manner as to correspond to the features presently recited in Applicant's claim 23 because Shigeyama explicitly teaches away from using spectroscopy methods such as the type presently recited in Applicant's claim 23.

Shigeyama teaches an amorphous silicon layer 6 being coated with an oxidizing liquid to form an oxide film 7, as shown in Fig. 4(b) and discussed in paragraph [0027] of the English language machine translation of Shigeyama. After forming this oxide film 7, catalyst sedimentary layers 8 are formed on the top of the oxide film 7, the amorphous silicon layer 6 is heated, and laser annealing equipment 3 is used to irradiate the amorphous silicon layer 6 with laser light while the irradiated spot is moved at a constant laser power to form a crystal film. Shigeyama also teaches inspecting a crystal film 2 with testing equipment 1, as shown in Fig. 2 of Shigeyama. During this inspecting, an image taken of the crystal film formed by the above method and the distribution characteristics of a density value are determined to evaluate crystallinity determined based on white concentration values 26 and black concentration values 27, as shown in Figs. 11 and 12 and discussed in paragraph [0035] of the English language machine translation of Shigeyama. Based on the result of the evaluation, a determination is made as to whether the laser energy value (laser power) is either too high or too low and the laser power of the laser can be corrected, as shown in Fig. 6 of Shigeyama. However, nowhere in any of the above steps is there any use of spectroscopy.

Conversely, in the method presently recited in Applicant's claim 23, laser processing is performed on a predetermined region of the amorphous silicon film that has undergone preprocessing while varying the laser power while moving the irradiated spot, and inspection using spectroscopy is performed at each of a plurality of positions at which the laser processing has been performed at different laser powers, so that the laser power is determined based on the results of the inspection. Additionally, Applicant's claim 23 also recites that inspection by imaging permits inspecting for a foreign object or an abnormality in the preprocessing step when the laser power is determined. Accordingly, this makes it possible to readily recognize a defect in the presence of which laser processing should not be performed, and thus helps reduce loss in production.

Further, not only does Shigeyama fail to teach or suggest using spectroscopy to determine a laser power, but Shigeyama explicitly teaches that determining the laser power should be performed without the use of spectroscopy. For example, paragraph [0009] of the English language machine translation of Shigeyama states, "In the art of checking the degree of crystallinity of a crystal film as the visual observation mentioned above is also, judgment dispersion by an observer's subjective observation occurs, and also with the art of checking a degree of crystallinity by the Raman spectrum measurement, offline inspection occurs, a routing counter increases and measuring time increases." Thus, Shigeyama explicitly teaches that the use of spectroscopy is undesirable because of the problems it causes.

Paragraph [0020] of the English language machine translation of Shigeyama goes on to further state:

If this invention is followed, it will become possible to irradiate a crystal film to be examined with inspection light from an omnidirection. Therefore, a reading error of a concentration value by scattered reflection resulting from an uneven state of a crystal film is cancelable. And since it becomes possible to picturize and inspect a crystal film in arbitrary inspection positions of the 1st and 2nd directions, inspection position adjustment of a crystal film to an irradiation means does not take time and effort, but inspection time can be shortened substantially.

Thus, the invention of Shigeyama is directed towards avoiding the problems caused by using spectroscopy. Accordingly, upon studying the disclosure of Shigeyama, one having ordinary skill in the art at the time of Applicant's invention would have been discouraged from using spectroscopy. As the Examiner is aware, a reference may be said to teach away when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that the applicant took. *In re Gurley*, 27 F.3d 551, 31 USPQ 2d 1130, 1131 (Fed. Cir. 1994).

Thus, Shigeyama clearly fails to teach or suggest, and in fact teaches away from, the method step of "laser power inspecting/extracting for inspecting for the presence of a foreign object or an abnormality in the preprocessing step by imaging by use of the amorphous silicon film having undergone the preprocessing step, and for performing laser preprocessing on a

predetermined region of the amorphous silicon film having undergone the preprocessing while varying laser power as an irradiated spot moves, and performing inspection using spectroscopy at each of a plurality of positions at which the laser processing has been performed at different laser powers, to determine a laser power based on a result of the inspection” as recited in Applicant’s claim 23.

Accordingly, Applicant respectfully requests reconsideration and withdrawal of the rejection of claim 23 under 35 U.S.C. § 103(a) as being unpatentable over Shigeyama.

In view of the foregoing remarks, Applicant respectfully submits that claim 23 is allowable. Claims 25, 28, 29, and 32-39 depend upon claim 23, and are therefore allowable for at least the reasons that claim 23 is allowable.

In view of the foregoing remarks, Applicant respectfully submits that this application is in condition for allowance. Favorable consideration and prompt allowance are solicited.

The Commissioner is authorized to charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account No. 50-1353.

Respectfully submitted,

Dated: August 18, 2011

/Erik Preston #64,733/
Attorneys for Applicant

KEATING & BENNETT, LLP
1800 Alexander Bell Drive, Suite 200
Reston, VA 20191
Telephone: (571) 313-7440
Facsimile: (571) 313-7421

Joseph R. Keating
Registration No. 37,368

Erik Preston
Registration No. 64,733